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Table X.

Transit D.—Central Illumination.

Observer, Captain Monro, R.N.

Date. 1907.	W—E. Means.	No. of Stars. W.	E.	Wt.
	s			
Sept. 18	−0·137	2,	3	1
19	+0·085	8,	10	2
23	+0·030	10,	8	2
24	+0·009	12,	10	2
30	+0·008	5,	8	2
Oct. 2	−0·014	8,	6	2
4	+0·150	9,	9	2
7	−0·052	8,	6	2
8	+0·021	8,	8	2
Mean	+0·020			

Observer, Lieut. Gibson, R.N.

Date. 1907.	W—E. Means.	No. of Stars. W.	E.	Wt.
	s			
Sept. 27	−0·149	3,	3	1
Oct. 2	+0·019	7,	7	2
4	+0·096	8,	8	2
7	−0·089	6,	4	1
8	−0·020	5,	8	2
Mean	−0·006			

On the Orbit of the Binary Star β 80.

By T. J. J. See, A.M., Ph.D. (Berol.).

This interesting and rapidly revolving system was discovered by Burnham with his celebrated 6-inch telescope at Chicago in 1874. It was measured by Dembowski the following year, and has since been followed regularly by the most active observers of close pairs. At first the motion was very slight, because the companion was near apastron, with a long radius vector and revolving slowly. But in the last ten years the motion has become very rapid both in angle and distance. The apparent orbit quite well represents the observations, as shown by the accompanying diagram. The material used is the complete measures given by Burnham in his General Catalogue of Double Stars, just published by the Carnegie Institution. The place of β 80 for the epoch of 1880 is $\alpha = 23^h\ 12^m\ 45^s$; $\delta = +4^\circ\ 45'$; mags. 8·2, 9·1.

The elements are as follows:—

$P = 63{\cdot}5$ years $\qquad \Omega = 107^\circ{\cdot}8$

$T = 1905{\cdot}30 \qquad i = 17^\circ{\cdot}6$

$e = 0{\cdot}726 \qquad \lambda = 10^\circ{\cdot}7$

$a = 0''{\cdot}626$

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Apparent orbit:—

Length of major axis = 1″·25
Length of minor axis = 0″·79
Angle of major axis = 117°·4
Angle of periastron = 117°·8
Distance of star from centre = 0″·452

No previous orbit for this star has been worked out. Some astronomers have expressed the opinion that the period could not be deduced until the companion returned to apparent apastron. But it will be seen that the observations fix the apastron with singular accuracy.

Comparison of computed with observed places for β 80.

t	θ_o	θ_c	θ_o-θ_c	ρ_o	ρ_c	ρ_o-ρ_c	Observer, Nights.
	°	°	°	″	″	″	
1875·80	300·4	300·9	−0·5	1·07	1·07	0·00	Δ, 5.
1877·79	306·1	302·4	+3·7	1·24	1·07	+0·17	β, 2.
1881·69	312·2	308·6	+3·6	0·91	1·02	−0·11	β, 3.
1886·94	316·1	316·7	−0·6	0·84	0·92	−0·08	LM, 1.
1888·75	319·5	319·8	−0·3	0·88	0·87	+0·01	β, 4; Lv, 3.
1891·57	322·5	325·5	−3·0	0·69	0·78	−0·09	β, 3.
1892·97	327·2	329·0	−1·8	0·60	0·74	−0·14	Sp, 3.
1893·60	328·5	330·5	−2·0	0·83	0·71	+0·12	Lv, 1; W, 3.
1894·84	325·1	334·4	−9·3	0·63	0·66	−0·03	Lewis, 1.
1898·77	340·3	336·0	+4·3	0·59	0·64	−0·05	β, 1; Bow, 1; A, 4.
1899·38	346·0	338·7	+7·3	0·45	0·61	−0·16	Bry, 4.
1900·65	358·6	351·6	+7·0	0·42	0·47	−0·05	Doo, 2; A, 2.
1901·83	13·8	12·4	+1·4	0·30	0·33	−0·03	Bry, 4; Doo, 2.
1902·75	24·3	29·8	−5·5	0·37	0·26	+0·11	Bry, 1; Lewis, 1.
1903·76	55·3	53·4	+1·9	0·22	0·21	+0·01	A, 2; Bry, 2.
1904·73	91·6	90·2	+1·4	0·16	0·18	−0·02	A, 2.
1905·65	136·4	134·8	+1·6	0·17	0·17	0·00	A, 2.
1906·52	163·8	172·4	−8·6	0·18	0·19	−0·01	A, 2.

Ephemeris.

t	θ_c	ρ_c	t	θ_c	ρ
	°	″		°	″
1908·7	209·0	0·28	1914·7	256·4	0·60
1909·7	222·5	0·33	1915·7	260·2	0·65
1910·7	233·3	0·39	1916·7	263·0	0·69
1911·7	241·3	0·45	1917·7	265·7	0·72
1912·7	247·2	0·50	1918·7	268·2	0·76
1913·7	252·4	0·56			

Dembowski measured the position here laid down on five nights in 1875. It happens that his observations both in angle and in distance are perfectly represented by this ellipse which satisfies the law of areas. Thus both ends and a full side of

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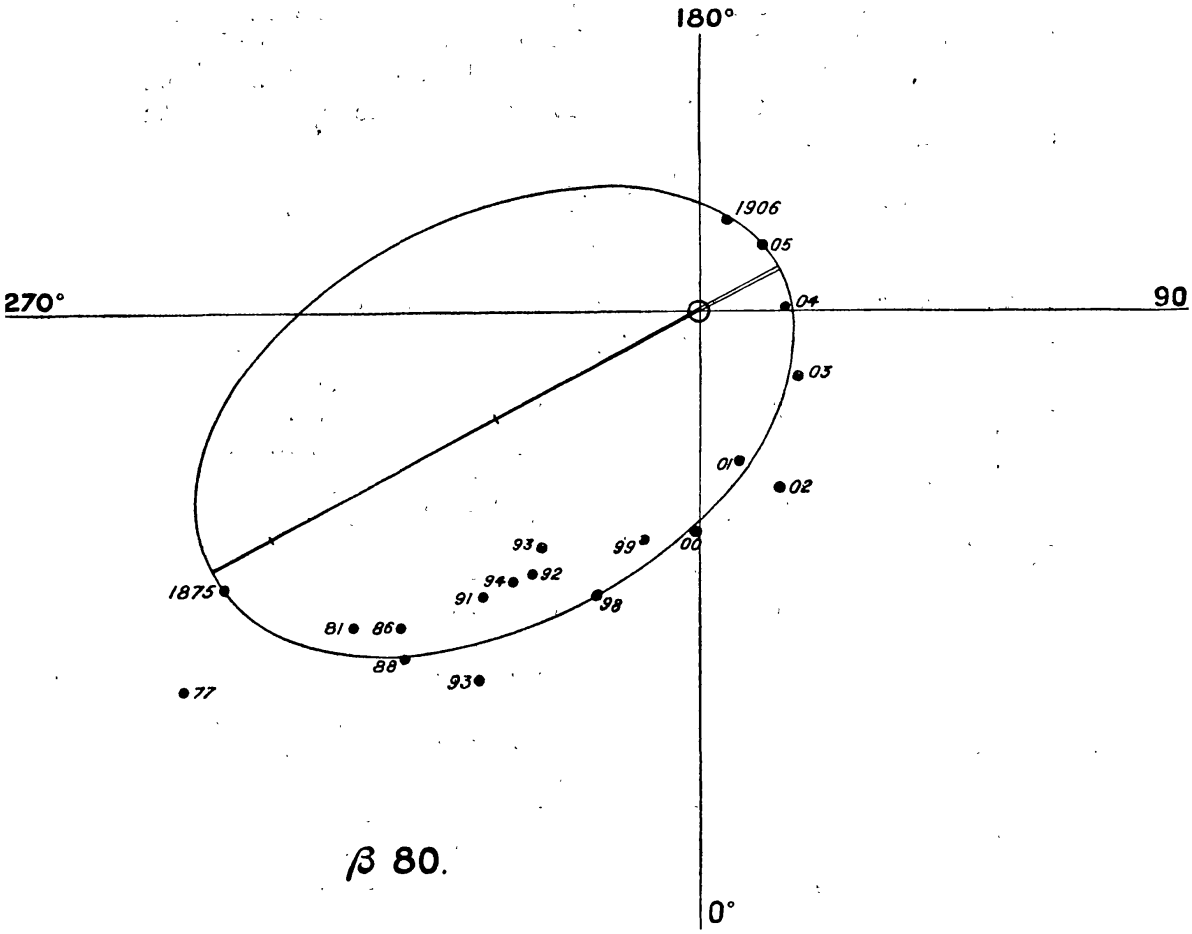
the apparent ellipse have already been described, and the observations of Aitken in 1905 and 1906, beyond periastron, show that the other side of the ellipse is almost identical with that already described. The elements are thus fixed with unusual accuracy. It seems likely that the period is not uncertain by more than one or two years, and that the eccentricity cannot depart from the value here given by more than ± 0·03.



This orbit illustrates the value of good observations advantageously placed. An ephemeris for the next ten years is added for the convenience of observers. This system deserves careful attention for some time, because the motion will be rapid both in angle and distance, and observations will be valuable in verifying the orbit.

As Burnham's General Catalogue gives all the measures used, it suffices to give a calculated comparison with the annual means as plotted in the diagram, which embraces all the best material.

U.S. Naval Observatory,
Mare Island, California,
1907 *December* 4.

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On the Orbit of β 513 = 48 Cassiopeiæ.

By T. J. J. See, A.M., Ph.D. (Berol.).

This remarkable binary was discovered by Burnham with the 18½-inch refractor at Chicago in 1878. Its place for the epoch 1880 is $\alpha = 1^h\ 52^m\ 7^s$; $\delta = +70°\ 19'$; and the magnitudes of the components are 5·0 and 7·0. The star is always close, and presents the same dfficulty in dividing the components as the systems 99 Herculis, 85 Pegasi, and τ Cygni, which can be well separated only by powerful instruments in good seeing. The measures of such unequal pairs are often vitiated by sensible systematic errors, so that the computer encounters difficulty in reconciling the observations to any orbit.

The orbit herewith presented gives the general character of the motion with essential accuracy, and will be useful to observers for the next ten or fifteen years, while the companion is again receding towards apastron.

The two ends and one side of the apparent ellipse have been described. The principle of areas shows that the orbit has a rather small eccentricity, and that it is not highly inclined. I am indebted to Professor Eric Doolittle, of the Flower Observatory of the University of Pennsylvania, for the last measure, which falls exactly on the orbit here laid down. His note on the measure was, "I am certain this is real; a perfect night."

Comparison of computed with observed places for β 513.

t	θ_o	θ_c	$\theta_o-\theta_c$	ρ_o	ρ_c	$\rho_o-\rho_c$	Observer, Nights.
	°	°	°	″	″	″	
1878·70	264·5	265·1	− 0·6	1·05	0·82	+0·23	Δ, 1; β, 3.
1879·40	265·0	267·2	− 2·2	0·95	0·82	+0·13	OΣ, 1; β, 2.
1881·67	271·9	273·6	− 1·7	0·76	0·81	−0·05	β, 1.
1883·78	269·7	280·2	−10·5	1·07	0·79	+0·28	En., 5.
1885·77	284·9	286·6	1·7	...	0·76	...	HΣ, 1.
1886·03	270·1	287·6	−17·5	1·03	0·75	+0·28	T., 4.
1888·70	298·1	297·4	+ 0·7	0·83	0·70	+0·13	β, 4.
1889·52	304·4	300·9	+ 3·5	0·76	0·67	+0·09	β, 3.
1890·62	308·6	305·8	+ 2·8	0·55	0·64	−0·09	β, 4.
1891·61	313·5	310·6	+ 2·9	0·58	0·62	−0·04	β, 4.
1892·99	317·2	316·4	+ 0·8	0·5±	0·58	−0·08	Sp., 1.
1893·47	322·2	321·2	+ 1·0	0·65	0·56	+0·09	Bax., 1.
1896·09	333·7	340·2	− 6·5	0·5±	0·48	+0·02	Sp., 1.
1898·92	5·9	7·3	− 1·4	0·36	0·42	−0·06	A., 3.
1899·72	11·6	16·3	− 4·7	0·42	0·41	+0·01	A., 3–2.
1900·76	29·3	28·2	+ 1·1	0·38	0·40	−0·02	A., 1.
1904·00	65·2	67·3	− 2·1	0·40	0·40	±0·00	A., 2.
1906·32	97·4	95·5	+ 1·9	0·37	0·39	−0·02	A., 2.
1907·93	118·8	115·9	+ 2·9	<0·4	0·39	+0·01	Doo., 1.